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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/693,758	10/23/2003	Svend Frolund	200311958-1	2462

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FORT COLLINS, CO 80527-2400

EXAMINER
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ROJAS, MIDYS

ART UNIT	PAPER NUMBER
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2185

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/12/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/693,758	<b>Applicant(s)</b> FROLUND ET AL.	
	<b>Examiner</b> Midys Rojas	<b>Art Unit</b> 2185	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 October 2006.
- 2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-26 and 29-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-26 and 29-31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>10/23/03, 7/21/05</u>   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election without traverse of claims 1-26 and 29-31 (Group 1) in the reply filed on October 5<sup>th</sup>, 2006 is acknowledged.

### ***Information Disclosure Statement***

2. The information disclosure statement (IDS) submitted on 10/23/03 and 07/21/05 have been considered by the examiner.

### ***Drawings***

3. The drawings received on 10/23/03 have been accepted by the examiner.

### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 1, 8, and 29 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Regarding Claims 1, 8, and 29, the specification does not provide a definition or explanation for the term "erasure coded data". This term is being interpreted by the examiner as any piece of data that can be striped.

Regarding Claims 1 and 29, the specification does not provide proper support or an explanation as to how the quorum meets a quorum condition and how any two selections of the number of the stripe blocks intersect in the minimum number. This limitation is being interpreted by the examiner as the quorum of storage devices comprising of the minimum number of storage devices necessary for the recovery of the data; wherein the quorum condition is met when the minimum number of storage devices necessary are available for use in the decoding of the stripe erasure data.

Regarding Claim 8, the specification does not provide proper support or an explanation as to how the quorum can comprise of a first number of data blocks and **half** of the parity blocks. This limitation is being interpreted by the examiner as the quorum comprising of some of the data blocks plus the parity blocks.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1, 8, and 29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding Claim 1, it is unclear what is meant by the limitation "...the quorum meeting a quorum condition of a number such that any two selections of the number of the stripe blocks intersect in the minimum number of the stripe blocks..." It is not understood how the quorum condition is being met.

Regarding Claim 8, it is unclear what is meant by the limitation "...the quorum of the reply messages including at least the first number of the stripe blocks, the quorum comprising the

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first number plus half of the second number...” It is not understood how the quorum can include at least the first number of the stripe blocks and also comprise the first number plus half the second number.

Regarding Claim 29, it is unclear what is meant by the limitation “...the quorum meeting a quorum condition of a number such that any two selections of the number of the stripe blocks intersect in the minimum number of the stripe blocks...” It is not understood how the quorum condition is being met.

Clarification of these claims is necessary.

These claims will be examined as best understood by the examiner.

### *Claim Rejections - 35 USC § 102*

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1, 4-7, and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Nishikawa et al. (US 2002/0083379 A1).

Regarding Claim 1, as best understood in view of the previous 112 rejections, Nishikawa discloses a method of reading data comprising the steps of:

receiving a request for a stripe of erasure coded data (interpreted as any data that can be striped) stored across a plurality of storage devices (external host device issues a data access request to that data storage array apparatus, paragraph 0007),

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the stripe comprising stripe blocks (if five data storage units are employed, a grouped cluster data is divided and stored into five disk, paragraph 0008);

sending read messages to at least a quorum of the storage devices (controller receives a data access request issued by the external host device and issues divided data access requests to the data storage units, paragraph 0007);

receiving at least the quorum of reply messages from the storage devices (the controller informs the external host device of transfer completion, paragraph 0007; data stored in the four data storage units is grouped and then transferred to the external host device, paragraph 0009 wherein the grouped data being transferred constitutes reply messages),

the quorum of the reply messages including at least a minimum number of the stripe blocks needed to decode the stripe of erasure coded data, the quorum of storage devices comprising of the minimum number of storage devices necessary for the recovery of the data; wherein the quorum condition is met when the minimum number of storage devices necessary are available for use in the decoding of the stripe erasure data (examiner's interpretation of the limitation "the quorum meeting a quorum condition of a number such that any two selections of the number of the stripe blocks intersect in the minimum number of the stripe blocks"; paragraph 0113, when one of the storage units fail, using the remaining storage units and the parity data wherein the minimum number of storage units necessary for recovering the cluster data is the four remaining storage units and the parity data);

and decoding the stripe of erasure coded data from at least the minimum number of the stripe blocks, thereby forming the data (the remaining four data storage units, and then the parity is calculated to recover one portion of the lost cluster data, paragraph 0113).

Regarding Claim 4, Nishikawa discloses the method wherein a coordinator performs the steps (Controller 3).

Regarding Claim 5, Nishikawa discloses the method wherein the coordinator comprises one of the storage devices (controller 3 is part of the overall data storage array, Figure 1).

Regarding Claim 6, Nishikawa discloses the method wherein the coordinator effectively sends one of the read messages to itself (controller receives a data access request issued by the external host device and issues divided data access requests to the data storage units, paragraph 0007; wherein the storage units are part of the data storage array and therefore the divided access request are sent from within the storage array).

Regarding Claim 7, Nishikawa discloses the method wherein the coordinator effectively receives one of the reply messages from itself (the controller informs the external host device of transfer completion, paragraph 0007; data stored in the four data storage units is grouped and then transferred to the external host device, paragraph 0009; since the result of the access request is first transferred from the storage units to the controller 3, and both the storage units and the controller are part of the data storage array; the reply message is essentially being communicated within the storage array).

Claim 29 is rejected using the same rationale as that of Claim 1.

*Claim Rejections - 35 USC § 103*

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 2, 8, 10-15, 17-23, 25-26, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishikawa et al. (US 2002/0083379 A1) in view of Dodd (2004/0158677 A1).

Regarding Claim 2, Nishikawa discloses the method a discussed in claim 1 above. Nishikawa does not teach each of the reply messages within the quorum indicating that there is no pending write for the stripe block stored on the storage device associated with the reply message. Dodd discloses control logic, which chooses to complete write transactions prior to the completion of read transactions. Therefore, when read transactions are completed, there are no pending write transactions (paragraph 0018). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Nishikawa to only perform the read operation when there are no write transactions pending, thus avoiding the reading of data that is not up to date (data that needs to be modified by a pending write).

Regarding Claim 8, Nishikawa discloses a method of reading data comprising the steps of:



receiving a request for a stripe of erasure coded data (interpreted as any data that can be striped) stored across a plurality of storage devices (external host device issues a data access request to that data storage array apparatus, paragraph 0007),

the stripe comprising stripe blocks which comprise a first number of data blocks and a second number of parity blocks (the data is divided and stored into four data storage units and the redundancy data is stored in the data storage unit 4e, paragraph 0008);

sending read messages to the storage devices (controller receives a data access request issued by the external host device and issues divided data access requests to the data storage units, paragraph 0007);

receiving at least a quorum of reply messages from the storage devices (the controller informs the external host device of transfer completion, paragraph 0007; data stored in the four data storage units is grouped and then transferred to the external host device, paragraph 0009);

the quorum of the reply messages including at least the first number of the stripe blocks, the quorum comprising the first number plus a the second number (interpreted by the examiner as the quorum comprising of some of the data blocks plus the parity blocks); and decoding the stripe of erasure coded data from the first number of the stripe blocks, thereby forming the first number of the data blocks (at this point, if one of the data storage units is failed, one portion of cluster data is read out from the remaining four data storage units, and then the parity is calculated to recover one portion of the lost cluster data, paragraph 0113).

Nishikawa does not teach each of the reply messages within the quorum indicating that there is no pending write for the stripe block stored on the storage device associated with the reply message. Dodd discloses control logic, which chooses to complete write transactions prior

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to the completion of read transactions. Therefore, when read transactions are completed, there are no pending write transactions (paragraph 0018). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Nishikawa to only perform the read operation when there are no write transactions pending, thus avoiding the reading of data that is not up to date (data that needs to be modified by a pending write).

Regarding Claim 10, Nishikawa discloses the method wherein a coordinator performs the steps (Controller 3).

Regarding Claim 11, Nishikawa discloses the method wherein the coordinator comprises one of the storage devices (controller 3 is part of the overall data storage array, Figure 1).

Regarding Claim 12, Nishikawa discloses the method wherein the coordinator effectively sends one of the read messages to itself (controller receives a data access request issued by the external host device and issues divided data access requests to the data storage units, paragraph 0007; wherein the storage units are part of the data storage array and therefore the divided access request are sent from within the storage array).

Regarding Claim 13, Nishikawa discloses the method wherein the coordinator effectively receives one of the reply messages from itself (the controller informs the external host device of transfer completion, paragraph 0007; data stored in the four data storage units is grouped and then transferred to the external host device, paragraph 0009; since the result of the access request

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is first transferred from the storage units to the controller 3, and both the storage units and the controller are part of the data storage array; the reply message is essentially being communicated within the storage array).

Regarding Claim 14, Nishikawa discloses the method wherein the coordinator is not one of the storage devices upon which the stripe of erasure coded data is stored (controller 3 is part of the data storage array but is not one of the storage units).

Regarding Claim 15, Nishikawa discloses the method further comprising the step of identifying a group of the storage devices as targets (paragraph 0008, units 4a to 4d are identified as the targets of the divided cluster data).

Regarding Claim 17, Nishikawa discloses the method wherein each of the query messages sent to the targets identifies the storage device as one of the targets (controller receives a data access request issued by the external host device and issues divided data access requests to the data storage units, paragraph 0007 wherein each data storage unit that receives a divided data access request has been identified as a target).

Regarding Claim 18, Nishikawa discloses the method wherein the reply messages from the targets include the stripe blocks (the controller informs the external host device of transfer completion, paragraph 0007; data stored in the four data storage units is grouped and then

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transferred to the external host device, paragraph 0009 wherein the results from the read request are considered to be the reply messages).

Regarding Claim 19, Nishikawa discloses the method wherein the storage devices comprise a distributed storage system (Figure 1, representing a RAID 3- striping storage system, paragraphs 0007 – 0009).

Regarding Claim 20, Nishikawa discloses the method wherein the distributed storage system comprises a quantity of the storage devices (Figure 1, representing a RAID 3- striping storage system, paragraphs 0007 – 0009 wherein the quantity of storage devices is five data storage units 4a to 4e).

Regarding Claim 21, Nishikawa discloses the method wherein the quantity of the storage devices corresponds to the first number of the data blocks plus the second number of the parity blocks (the first number of the data blocks are in storage units 4a to 4d and the second number of the parity blocks are in storage unit 4e).

Regarding Claim 22, Nishikawa discloses the method wherein the quantity of the storage devices exceeds the first number of the data blocks plus the second number of the parity blocks (although not shown, the system of figure 1 may include other storage units that are not part of the RAID-3 system and are not part of the storage array. For example, the host device may have internal storage units).

Claim 23 is rejected using the same rational as that of Claim 17.

Regarding Claim 25, Nishikawa discloses the method wherein read messages are divided and issued to the individual data storage units (paragraph 0007) and these individual requests must include an indicator of what stripe needs to be accessed (stripe indicator).

Regarding Claim 26, Nishikawa discloses the method wherein data stored in the four data storage units is grouped and then transferred to the external host device (paragraph 0009) wherein the results from the read request are considered to be the reply messages and the reply messages must include stripe indicators in order to enable the grouping of the cluster data in the correct order.

Claim 30 is rejected using the same rationale as that of Claim 2.

12. Claims 3 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishikawa et al. (US 2002/0083379 A1) in view of Milligan et al. (6,973,556).

Regarding Claim 3, Nishikawa discloses the method of claim 1. Nishikawa does not teach each of the reply messages within the quorum indicating that the stripe block associated with the reply message has a timestamp that matches other timestamps associated with other reply messages within the quorum. Milligan discloses a RAID stripping system that uses

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metadata to indicate striping information (Col. 4, lines 44-50). Milligan teaches the use of timestamp to indicate the relative sequence of the stripes and for data reconstruction (Col. 5, line 60 – Col. 6, line 5). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Nishikawa to use timestamps as done in Milligan to aid in the proper ordering of stripes when reconstructing or grouping the requested data.

Claim 31 is rejected using the same rationale as that of Claim 3.

13. Claims 9 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishikawa et al. (US 2002/0083379 A1) in view of Dodd (2004/0158677 A1) further in view of Milligan et al. (6,973,556).

Regarding Claim 9, Nishikawa et al. (US 2002/0083379 A1) in view of Dodd (2004/0158677 A1) discloses the method of claim 8. Nishikawa et al. (US 2002/0083379 A1) in view of Dodd (2004/0158677 A1) does not teach the quorum of the reply messages including validation timestamps, which match. Milligan discloses a RAID striping system that uses metadata to indicate striping information (Col. 4, lines 44-50). Milligan teaches the use of timestamp to indicate the relative sequence of the stripes and for data reconstruction (Col. 5, line 60 – Col. 6, line 5). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Nishikawa to use timestamps as done in Milligan to aid in the proper ordering of stripes when reconstructing or grouping the requested data.

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Regarding Claim 24 Nishikawa et al. (US 2002/0083379 A1) in view of Dodd (2004/0158677 A1) discloses the method of claim 8. Nishikawa et al. (US 2002/0083379 A1) in view of Dodd (2004/0158677 A1) does not teach each of the storage devices comprising a log, wherein the log comprises log entries of each successful write of data, the log entries comprising a stripe indicator, a write timestamp, and a physical location of the stripe block on the storage device. Milligan discloses a RAID stripping system that uses metadata to indicate striping information (Col. 4, lines 44-50). Wherein metadata of striping information may include stripe indicators. Milligan teaches the use of timestamp to indicate the relative sequence of the stripes and for data reconstruction (Col. 5, line 60 – Col. 6, line 5). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Nishikawa to use timestamps as done in Milligan to aid in the proper ordering of stripes when reconstructing or grouping the requested data.

14. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nishikawa et al. (US 2002/0083379 A1) in view of Dodd (2004/0158677 A1) and further in view of Oota (2004/0064633 A1).

Regarding Claim 16, Nishikawa et al. (US 2002/0083379 A1) in view of Dodd (2004/0158677 A1) discloses the method of claim 15. Nishikawa et al. (US 2002/0083379 A1) in view of Dodd (2004/0158677 A1) does not teach the step of identifying the targets randomly. Oota discloses determining the striping destination randomly (paragraph 0009). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the

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system of Nishikawa to determine the striping destination at random thus avoiding a strong probability of a convoy effect (motivation of Oota, paragraph 0009).

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Midys Rojas whose telephone number is (571) 272-4207. The examiner can normally be reached on M-F 5:30am - 4:00pm.

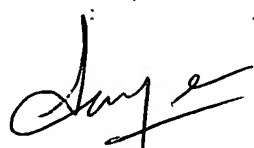
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sanjiv Shah can be reached on (571) 272-4098. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

  
Midys Rojas  
Examiner  
Art Unit 2185

MR

January 3, 2007

  
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